

Amendments to the Claims:

This listing of claims replaces all prior versions and listings of claims in the application:

Listing of Claims:

1. (Currently Amended) A method for rebalancing ~~the disks among the~~multiple network storages ~~storage devices~~ in a virtualized network storage system including a network connecting the multiple network storage devices, ~~and~~ a virtualizing device, ~~and a network for connecting them,~~ wherein said multiple network storage devices virtually ~~look appear~~ to clients as if the network storage devices were a single network storage device owing to the functions of said virtualizing device, the method comprising:

a rebalancing process which comprises the steps of:

a disk rebalancing step that includes moving one or more files stored in a first network storage device of said multiple network storage devices to a second network storage device of said multiple network storage devices ~~(disk rebalancing step)~~; and

a termination judging step that includes examining the free disk spaces in the individual network storage devices to judge whether to continue ~~the disk rebalancing processing~~ based on ~~the~~ a maximum value and a minimum value of the free disk spaces and a first threshold and, if the processing should be continued,

going back to said disk rebalancing step and if the processing is not to be continued, terminating the processing ~~(termination judging step)~~; and

a monitoring process which comprises the steps of:

a first start of rebalancing determining step that includes periodically examining the free disk space in each of said multiple network storage devices, and judging based on the maximum value and minimum value of the free disk spaces and a second threshold whether to start the rebalancing process ~~(first start of rebalancing determining step)~~; and

a rebalancing starting step in which, if it is judged in the first start of rebalancing determining step that rebalancing should be started, starting the rebalancing process is started ~~(rebalancing starting step)~~.

2. (Currently Amended) The method for rebalancing ~~the disks among the multiple network storages~~ storage devices in a virtualized network storage system, according to Claim 1, wherein in said termination judging step in said rebalancing process, if ~~the a~~ difference between the maximum value and minimum value of the free disk spaces is equal to or greater than the first threshold, the ~~operation process goes~~ back to the disk rebalancing step to continue the processing and if not, the processing is terminated.

3. (Currently Amended) The method for rebalancing ~~the disks among the multiple network storages~~ storage devices in a virtualized network storage system, according

to Claim 1, wherein, in the first start of rebalancing determining step in said monitoring process, if the difference between the maximum value and minimum value of the free disk spaces is equal to or greater than the second threshold, it is determined that the rebalancing process should be started.

4. (Currently Amended) The method for rebalancing ~~the disks among the~~multiple network storages-storage devices in a virtualized network storage system, according to Claim 1, wherein, in addition to said first start of rebalancing determining step, said monitoring process comprises a second start of rebalancing determining the step-of: in which, if the free disk space in at least one of said multiple network storage devices is less than a third threshold, ~~determining start of the rebalancing is determined (second start of rebalancing determining step)~~, and

in said rebalancing starting step, if start of rebalancing is determined both in said first start of rebalancing determining step and in said second start of rebalancing determining step, said rebalancing process is started.

5. (Currently Amended) The method for rebalancing ~~the disks among the~~multiple network storages-storage devices in a virtualized network storage system, according to Claim 1, wherein, in addition to said first start of rebalancing determining step, said monitoring step comprises a third start of rebalancing the step-of: in which, if the free disk spaces in all the network storage devices are equal to or greater than a

fourth threshold, ~~determining start of rebalancing is determined~~(~~third start of rebalancing determining step~~); and

in said rebalancing starting step, if start of rebalancing is determined both in the first start of rebalancing determining step and in the third start of rebalancing determining step, the rebalancing process is started.

6. (Currently Amended) The method for rebalancing ~~the disks among the~~multiple network storages-storage devices in a virtualized network storage system, according to Claim 1, wherein in addition to said first start of rebalancing determining step, said monitoring process comprises a fourth start of rebalancing ~~the step of:~~ in which, if the frequency of accesses from clients to said virtualized network storage system is less than a fifth threshold, ~~determining start of rebalancing is determined~~(~~fourth start of rebalancing determining step~~);

in said rebalancing starting step, if start of rebalancing is determined both in said first start of rebalancing determining step and in the fourth start of rebalancing determining step, the rebalancing process is started; and

in the termination judging step in said rebalancing process, the free disk space in each of said multiple network storage devices is examined₁ and if ~~the~~a difference between the maximum value and minimum value of the free disk spaces is equal to or greater than said first threshold₁ and further₁ the frequency of accesses from clients to said virtualized network storage system is less than the fifth threshold,

the ~~operation process~~ goes back to said disk rebalancing step in said rebalancing process, and

if the difference is less than the first threshold or the frequency of the accesses is equal to or greater than the fifth threshold, the processing is terminated.

7. (Currently Amended) The method for rebalancing ~~the disks among the multiple network storages~~ storage devices in a virtualized network storage system, according to Claim 1, wherein said virtualizing device has a free disk space table, and the free disk space table holds ~~the an~~ identifier of each of said multiple network storage devices and the free disk space in each of said multiple network storage devices.

8. (Currently Amended) The method for rebalancing ~~the disks among the multiple network storages~~ storage devices in a virtualized network storage system, according to Claim 1, wherein said disk rebalancing step in said rebalancing process comprises of the steps of:

a network storage device selecting step that includes selecting a network storage device having the smallest free disk space as ~~the a~~ source network storage device and a network storage device having the largest free disk space as ~~the a~~ destination network storage device ~~(network storage device selecting step)~~;

a file selecting step that includes selecting one or more files stored in the source network storage device selected in the network storage device selecting step ~~(file selecting step)~~; and

a file moving step that includes moving the files selected in the file selecting step from the source network storage device to the destination network storage device ~~(file moving step)~~.

9. (Currently Amended) The method for rebalancing ~~the disks among the~~ multiple network storages-storage devices in a virtualized network storage system, according to Claim 8, wherein said disk rebalancing step in said rebalancing process further comprises the step of storing the history of rebalancing, and

in said network storage device selecting step, network storage devices selected as the source network storage device in the past are excluded from objects to be selected as the destination network storage device and network storage devices selected as the destination network storage device in the past are excluded from objects to be selected as the source network storage device.

10. (Currently Amended) The method for rebalancing ~~the disks among the~~ multiple network storages-storage devices in a virtualized network storage system, according to Claim 8, wherein said file selecting step in said disk rebalancing step in said rebalancing process further comprises the step of comparing a first estimated value which is equal to ~~the~~ a sum of the free disk space in the source network storage device and ~~the~~ a size of the files selected to be moved with a second estimated value which is equal to ~~the~~ a difference between the free disk space in the destination network storage device and the size of files to be moved, and if the

magnitude relation between the first estimated value and the second estimated value is inverted with respect to the magnitude relation between the free disk space in the source network storage device and the free disk space in the destination network storage device, files to be moved are reselected.

11. (Currently Amended) The method for rebalancing ~~the disks among the multiple network storages~~ storage devices in a virtualized network storage system, according to Claim 8, wherein

said virtualizing device has file location information which is a record of ~~the a~~ correlation between files and network storage devices to which the files belong,

said file moving step comprises the steps of: copying files stored in said source network storage device to said destination network storage device (~~copying step~~), deleting the files from said source network storage device, and updating said file location information, and

if a user sends a write access request into a file while the file is being moved, the file moving step is aborted, the file to be moved is deleted from the destination network storage, and the file selecting step is carried out again.

12. (Currently Amended) The method for rebalancing ~~the disks among the multiple network storages~~ storage devices in a virtualized network storage system, according to Claim 1, wherein

said virtualizing device has file location information which is a record of ~~the a~~
correlation between files and network storage devices which ~~stores-store~~ the files,

said file moving step comprises the steps of: copying files to be moved in from
said source network storage device to said destination network storage device
(~~copying step~~), deleting said files to be moved from said source network storage
device, and updating said file location information, and

the virtualizing device comprises a means for, if a user sends a write access
request into said file while the file moving step is being carried out, abandoning the
access request.

13. (Currently Amended) The method for rebalancing ~~the disks among the multiple~~
network storages storage devices in a virtualized network storage system, according
to Claim 1, wherein, in response to an instruction to start from an administrator, said
rebalancing process is started, and in response to an instruction to abort from the
administrator, said rebalancing process is aborted.

14. (Currently Amended) The method for rebalancing ~~the disks among the multiple~~
network storages storage devices in a virtualized network storage system, according
to Claim 1, wherein said monitoring process is repeatedly carried out at preset time
intervals.

15. (Currently Amended) A method for rebalancing ~~the disks among the multiple~~ network ~~storages~~ storage devices in a virtualized network storage system including a network connecting the multiple network storage devices, and a virtualizing device, ~~and a network for connecting them,~~ wherein said multiple network storage devices virtually ~~look appear~~ to clients as if the storage devices were a single network storage device owing to the functions of said virtualizing device, the method comprising:

a rebalancing process which comprises the steps of:

a disk rebalancing step that includes migrating a file group comprising one or more files stored in a first network storage device of said multiple network storage devices to a second network storage device of said multiple network storage devices ~~(disk rebalancing step)~~ and

a termination judging step that includes examining ~~the free disk spaces~~ in the individual network storage devices, judging based on ~~the~~ a maximum value and a minimum value of the free disk spaces and a first threshold whether to continue ~~the rebalancing processing,~~ and if the processing it to be continued, going back to said disk rebalancing step, and if the processing is not to be continued, terminating the processing ~~(termination judging step);~~ and

a monitoring process which comprises the steps of:

a first start of rebalancing determining step that includes periodically examining the free disk space in each of said multiple network storage devices, and judging whether to start the rebalancing process based on the maximum value and

minimum value of the free disk spaces and a second threshold ~~(first start of rebalancing determining step)~~ and

a rebalancing starting step that includes starting said rebalancing process if it is judged in the first start of rebalancing determining ~~judging~~ step that rebalancing should be started ~~(rebalancing starting step)~~.

16. (Currently Amended) The method for rebalancing ~~the disks among the multiple network storages~~ storage devices in a virtualized network storage system, according to Claim 15, wherein

said disk rebalancing step in said rebalancing process comprises the steps of:

a network storage device selecting step that includes selecting a network storage device having the smallest free disk space as the a source network storage device and a network storage device having the largest free disk space as the a destination network storage device ~~(network storage device selecting step)~~;

a file group selecting step that includes selecting one or more of file groups stored in the source network storage device selected in the network storage device selecting step ~~(file group selecting step)~~; and

a file group migrating step that includes migrating the target file groups selected for migration in the file group selecting step from the source network storage device to the destination network storage device ~~(file group migrating step)~~.

17. (Currently Amended) The method for rebalancing ~~the disks among the multiple network storages~~ storage devices in a virtualized network storage system, according to Claim 16, wherein

said virtualizing device records ~~the a~~ relation between file groups and network storage devices to which the file groups belong as group location information,

said file group migrating step comprises the steps of: copying all ~~the~~ files belonging to the target file group for migration in said source network storage device to said destination network storage device ~~(copying step)~~, deleting all the files belonging to the target file group for migration from said source network storage device, and updating said group location information, and

if a user sends a write access request into at least one file belonging to the target file group for migration while the file is being migrated, the file group migrating step is aborted, all the files belonging to the target file group for migration are deleted from the destination network storage, and said file group selecting step is carried out again.

18. (Currently Amended) The method for rebalancing ~~the disks among the multiple network storages~~ storage devices in a virtualized network storage system, according to Claim 16, wherein

said virtualizing device records ~~the a~~ relation between file groups and network storage devices to which the file groups belong as group location information,

said file group migrating step comprises the steps of: copying all the files belonging to the target file group for migration in said source network storage device to said destination network storage device ~~(copying step)~~, deleting all the files belonging to the target file group for migration from said source network storage device, and updating said group location information, and

said virtualizing device comprises a means for, if a user sends a write access request into at least one file belonging to the target file group for migration while the file group migrating step is being carried out, abandoning the access request.

19. (Currently Amended) A virtualized network storage system including a network connecting multiple network storage devices, and a virtualizing device, and a network between them, wherein said multiple network storage devices virtually ~~look~~ appear to clients as if the network storage devices were a single network storage device owing to said virtualizing device, the system, wherein

said virtualizing device comprises a holding means for holding file location information indicating ~~the~~ a correlation between files and network storage devices which stores ~~the~~ files, a virtualizing means, and a disk rebalancing means, and

the disk rebalancing means further comprises:

a free disk space measuring unit which measures ~~the~~ free disk spaces in ~~the~~ individual network storage devices;

a rebalancing controller which

determines ~~the~~ a difference between ~~the~~ a maximum value and a minimum value of the free disk space in each of the individual network storage devices obtained from said free disk space measuring unit,

determines to start rebalancing if the difference is equal to or greater than a first threshold,

selects a network storage device having the smallest free disk space as ~~the~~ a source network storage device and a network storage device having the largest free disk space as ~~the~~ a destination network storage device, and

stops said rebalancing when the difference between the maximum value and minimum value of the free disk spaces falls below a second threshold; and

a file object mover which moves files from the selected source network storage device to the destination network storage device and thereby carries out said rebalancing.

20. (Currently Amended) The virtualized network storage system according to Claim 19, wherein said virtualizing device has a free disk space table and the free disk space table holds ~~the~~ an identifier of each of said multiple network storage devices and free disk space in each of said multiple network storage devices.

21. (Original) The virtualized network storage system according to Claim 19, wherein

said file object mover moves files by: copying files in the source network storage device to said destination network storage device; deleting the files from the source network storage device, and updating said file location information, and

said virtualizing means comprises a means which operates in parallel with the file object mover and if a user sends a write access request into a file to be moved by the file object mover, abandons the access request.

22. (Currently Amended) The virtualized network storage system according to Claim 19, wherein

the virtualizing device further comprises a management unit which receives instructions from an administrator and modifies the a configuration of the virtualizing device according to said instructions, and

the management unit causes said rebalancing controller to determine start of rebalancing based on the difference between the maximum value and minimum value of the free disk spaces when receiving an instruction to start free disk space rebalancing from the administrator, and stops said rebalancing control means when receiving an instruction to terminate free disk space rebalancing from the administrator.

23. (Original) The virtualized network storage system according to Claim 19, wherein

the virtualizing device further comprises a counter which causes said rebalancing controller to determine start of rebalancing based on the difference between the maximum value and minimum value of the free disk spaces at preset time intervals.